

**CADTH RAPID RESPONSE REPORT:
SUMMARY WITH CRITICAL APPRAISAL**

Bipolar versus Monopolar Transurethral Resection of the Prostate or GreenLight Laser Treatment: A Review of Clinical and Cost-Effectiveness

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Context and Policy Issues

Benign prostatic hyperplasia or hypertrophy (BPH) indicates the physical enlargement of the prostate gland due to benign histologic changes. BPH becomes increasingly common as men age.¹ The clinical manifestations of BPH are often chronic, although they could be acute, symptoms of lower urinary tract obstruction. The severity of symptoms of BPH usually assessed with either the International Prostate Symptom Score (IPSS) or the American Urological Association Symptom Index (AUASI).² Both of assessment methods are similar.²

In general, lower urinary tract obstruction symptoms (i.e., urinary retention) only require therapy if they have a significant impact on a patient's quality of life.^{3,4} Surgical intervention is needed when the lower urinary tract obstruction symptoms are inadequately relieved by medication, with the development of complications, and according to patient preference.² Surgery has generally been recommended for patients with symptoms of acute urinary retention that is refractory to medical therapy.^{5,6} The absolute indications for primary surgical intervention of BPH are as follows: refractory urinary retention, recurrent urinary tract infections due to prostatic hypertrophy, recurrent gross hematuria, renal insufficiency secondary to bladder outlet obstruction, bladder calculi, permanently damaged or weakened bladders, and large bladder diverticula that do not empty well secondary to an enlarged prostate.⁷

The surgical procedures for BPH include bipolar or monopolar transurethral resection of the prostate (B-TURP or M-TURP), laser enucleation (i.e., Holmium laser enucleation of the prostate [HoLEP], Thulium laser enucleation of the prostate [ThuLEP]), holmium-Nd:YAG high powered "red" laser, potassium titanyl phosphate (KTP or GreenLight laser), plasma vaporization (i.e., the "button" procedure), transurethral incision of the prostate (TUIP), photoselective vaporization (PVP), radiofrequency ablation, transurethral microwave thermotherapy (TUMT), prostatic urethral lift (PUL), and open prostatectomy.^{5,6,8,9} The choice of procedure for the treatment of BPH is based upon patient values, medical risk, and the impact of potential complications. For most patients who require a surgical procedure to treat BPH, transurethral resection of the prostate (TURP) has been the main form of treatment for many years in men with benign prostatic hyperplasia and remains the standard against other treatments.^{10,11} TURP is a urological operation and performed by visualizing the prostate through the urethra and removing tissue by electrocautery or sharp dissection. This procedure is done with spinal or general anesthetic. A triple lumen catheter is inserted through the urethra to irrigate and drain the bladder after the surgical procedure is complete.^{8,9} TURP includes traditional monopolar TURP (M-TURP, using monopolar electrocautery) and bipolar TURP (B-TURP, using bipolar electrocautery).⁵ B-TURP using a bipolar device is a newer technique that uses bipolar current to remove the tissue.^{8,9} B-TURP allows saline irrigation and eliminates the need for an electrosurgical unit (ESU) grounding pad thus preventing post-TURP hyponatremia (TUR syndrome) and reducing other complications.^{5,9}

The aim of this document is to review the comparative clinical effectiveness and safety, as well as the cost-effectiveness profile of B-TURP versus M-TURP or GreenLight Laser treatment.

Research Question

1. What is the comparative clinical effectiveness of bipolar versus monopolar transurethral resection of the prostate (TURP) or GreenLight laser treatment in patients with benign prostatic hyperplasia, obstruction or urinary retention?
2. What is the cost-effectiveness of bipolar versus monopolar TURP or GreenLight laser treatment in patients with benign prostatic hyperplasia, obstruction or urinary retention?

Key Findings

The evidence reviewed in this document suggested a similar clinical efficacy comparing B-TURP and M-TURP, but B-TURP may be associated with fewer adverse events. There was no evidence identified comparing B-TURP with GreenLight laser treatment. No cost-effectiveness evidence on B-TURP compared with M-TURP or GreenLight laser treatment was identified. Due to the various limitations of the body evidence, the findings of the document should be interpreted with caution.

Methods

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval to study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2012 and January 30, 2017. Rapid Response reports are organized so that the evidence for each research question is presented separately.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Patients with benign prostatic hyperplasia, obstruction, or urinary retention
Intervention	Bipolar transurethral resection of the prostate (B-TURP)
Comparator	Monopolar TURP; GreenLight laser, photo selective vaporization of the prostate
Outcomes	<p>Q1: Clinical effectiveness (e.g., International Prostate Symptom Score [IPSS], health-related quality of life, maximum urinary flow rate, re-TURP, operative time, perioperative complications, catheterization time, volume of blood products transfused, hospital stay);</p> <p>Safety (e.g., need for blood transfusion, urinary tract infections, urethral strictures, urinary incontinence, erectile dysfunction, mortality, TUR syndrome, clot retention, bladder neck constriction)</p> <p>Q2: Cost-effectiveness outcomes (e.g., cost per quality adjusted life year, cost per health benefit)</p>

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1.

Critical Appraisal of Individual Studies

The methodological quality of the included SR/MA were assessed using the Assessment of Multiple Systematic Reviews (AMSTAR) tool.³ A numeric score was not calculated for each study. Instead, the strengths and weakness of each study were summarized and described narratively.

Summary of Evidence

Quantity of Research Available

A total of 325 citations were identified in the literature search. Following screening of titles and abstracts, 320 citations were excluded and five potentially relevant reports from the electronic search were retrieved for full-text review. In addition, two potentially relevant publications were retrieved from the grey literature search. Of these seven potentially relevant articles, two publications were excluded due the study design (not systematic reviews), while five publications met the inclusion criteria and were included in this report. No evidence was identified for the question on cost-effectiveness. Appendix 1 describes the PRISMA flowchart of the study selection.

Summary of Study Characteristics

What is the comparative clinical effectiveness of bipolar versus monopolar transurethral resection of the prostate (TURP) or GreenLight laser treatment in patients with benign prostatic hyperplasia, obstruction or urinary retention?

A summary of the study characteristics can be found in Appendix 2.

The systematic review by Cornu et al.¹² was published in 2015, in which, relevant RCTs published between 1992 and 2013 were included. In total, 69 RCTs compared B-TURP with M-TURP, Holmium laser enucleation of the prostate (HoLEP), or GreenLight photoselective vaporization were included in the systematic review. Efficacy was evaluated after a minimum follow-up of one year. The outcomes assessed included International Prostate Symptom Score (IPSS), maximum urine flow rate (MUFR), postvoid residual volume (PVRV), and adverse events. Meta-analysis was performed that compared the efficacy and adverse events of B-TURP with M-TURP. No results comparing B-TURP with GreenLight laser were presented.

The systematic review by da Silva et al.¹³ was published in 2015, in which, relevant RCTs published between 2005 and 2015 were included. In total, 14 RCTs compared B-TURP with M-TURP, HoLEP, bipolar plasma vaporization of the prostate (BPVR) and bipolar plasmakinetic enucleation of the prostate (BPEP). The outcomes assessed were operative time, catheterization time, number of blood products transfused, hospital stay, postvoid residual volume and adverse events. No meta-

analysis was performed for any outcomes for B-TURP comparing with M-TURP or any other surgical procedures.

The systematic review by Tang et al.¹⁰ was published in 2014, in which, relevant RCTs published up to 2013 were included. In total, 31 RCTs comparing B-TURP with M-TURP were included in the systematic review. The outcomes assessed included International Prostate Symptom Score, maximum urine flow rate and adverse events. Results were pooled with meta-analysis.

The systematic review by Omar et al.¹⁴ was published in 2014, in which, relevant RCTs published 1966 to 2012 were included. In total, 24 RCTs comparing B-TURP with M-TURP were included in the systematic review. The outcomes assessed included International Prostate Symptom Score, quality of life, maximum urine flow rate and adverse events. Results were pooled with meta-analysis.

The systematic review by Lee et al.¹¹ was published in 2013, in which, relevant RCTs published 1997 to 2011 were included. In total, 36 RCTs, that compared B-TURP with M-TURP, HoLEP, BPVP, potassium-titanyl-phosphate (KTP) and transurethral vaporization of the prostate (TUV) were included in the SR. The outcomes assessed included International Prostate Symptom Score, quality of life, maximum urine flow rate and adverse events. No pooled data was reported to compare B-TURP with B-TURP, HoLEP, BPVP, KTP and TUV.

No systematic review was identified on the cost-effectiveness of B-TURP versus M-TURP or GreenLight laser treatment in patients with benign prostatic hyperplasia, obstruction or urinary retention.

Summary of Critical Appraisal

The strengths and limitations of included studies are summarized in Appendix 3. All systematic reviews clearly defined research question and study selection criteria. All systematic reviews performed comprehensive literature searches except the two systematic reviews^{11,13} in which only one database was searched. In two SRs,^{13,14} the study selection was performed by two independent reviewers; while in the remaining three systematic reviews¹⁰⁻¹² whether the selection was performed in a duplicate manner was not described. The data extraction was conducted by two independent reviewers in two systematic reviews,^{10,14} but duplicate data extraction was not described in other three systematic reviews.¹¹⁻¹³ A quality assessment of the included studies was conducted in four systematic reviews,^{10-12,14} but not performed in one systematic reviews.¹³ Unmet AMSTAR criteria included not providing a list of excluded studies and not appropriately considering the scientific quality of the included studies in formulating conclusions. The methodological quality of two included systematic reviews^{11,13} were considered poor per AMSTAR criteria because literature search was not comprehensive.

Summary of Findings

What is the comparative clinical effectiveness of bipolar versus monopolar transurethral resection of the prostate (TURP) or GreenLight laser treatment in patients with benign prostatic hyperplasia, obstruction or urinary retention?

A summary of the main results reported in the systematic reviews are presented in Appendix 4.

Cornu et al.¹² reported that no significant difference was found in terms of short-term efficacy (measured at 12 weeks after the surgery for IPSS, PVRV and prostate volume) between B-TURP and M-TURP with the exception of MUFR (Qmax), which showed a statistically significant greater MUFR in patients with B-TURP compared with those with M-TURP (B-TURP versus M-TURP: mean difference 1.26, 95% confidence interval [CI], 0.31 to 2.21, $p = 0.009$). However, B-TURP was associated with a lower rate of perioperative complications, such as transfusion rate, UTI, acute urinary retention, TUR syndrome etc. (Appendix 4). The authors concluded that B-TURP resulted in better perioperative outcomes and similar short term outcomes compared with M-TURP. No data comparing B-TURP with GreenLight laser was reported.

The systematic review/meta-analysis by Tang et al.¹⁰ indicated numerical but not statistically significant improvement in MUFR (Qmax) in the B-TURP compared with M-TURP groups (B-TURP versus M-TURP: mean difference: 0.36, $p = 0.12$). Safety analysis reported a statistically significant lower incidence of transurethral resection (TUR) syndrome and clot retention in B-TURP than that with M-TURP. In patients with B-TURP, statistically significant fewer blood transfusions were required compared with those in M-TURP (See Appendix 4). The authors concluded that that B-TURP was significantly better in the result of Qmax and for decreasing the incidence of TUR syndrome and clot retention. No clinical or statistically significant differences were found for adverse events such as transfusions, retention after catheter removal, and urethral complications between both groups.

In the systematic review by Omar et al.,¹⁴ no statistically significant differences were found between B-TURP and M-TURP in terms of IPSS or health-related quality of life (HRQL) score. The maximum urinary flow rate was statistically higher with B-TURP than M-TURP at 12 months (B-TURP versus M-TURP, mean difference: 1.30, 95%CI, 0.77 to 1.83, $p < 0.001$). B-TURP was associated with fewer adverse events including transurethral resection syndrome (risk ratio [RR] 0.12, 95% CI, 0.05 to 0.31, $p < 0.001$), clot retention (RR 0.48, 95% CI 0.30 to 0.77, $p = 0.002$) and blood transfusion (RR 0.53, 95% CI, 0.35 to 0.82, $p = 0.004$). The authors concluded that there is no overall difference between B-TURP and M-TURP for clinical effectiveness, but B-TURP is associated with fewer adverse events.

In terms of functional outcomes (such as IPSS), operation time; catheterization time, hospital stay and adverse events, the findings were inconsistently reported across the included studies in the systematic review by da Silva et al.¹³ No meta-analysis was performed for any outcome and for any comparisons in this systematic review. However, the author concluded that the use of B-TURP in the surgical treatment of patients with BPH was safe and is associated with improvements in perioperative outcomes. Short and mid-term functional outcomes were comparable with M-TURP, but better clinical evaluation was needed for long term functional outcomes.

No meta-analysis data was reported to compare B-TURP with M-TURP in the systematic review by Lee et al.¹¹ It was described that B-TURP showed comparable functional outcomes (such as post-void residual urine volume and maximum flow rate)

to TURP (type of TURP not reported, but likely M-TURP) and a shorter length of urethral catheterization and lower intraoperative and perioperative complications. The author concluded that there were no statistically significant differences in any of the modalities compared with TURP.

No systematic review was identified on the cost-effectiveness of B-TURP versus M-TURP or GreenLight laser treatment in patients with benign prostatic hyperplasia, obstruction or urinary retention.

Limitations

Despite the methodological strength of these meta-analyses/systematic reviews that focused on a variety of patient-focused and clinically important outcomes, there are multiple limitations that influence both internal and external validity. Two systematic reviews^{11,13} did not perform a comprehensive literature search (i.e., only one database was searched). The study selection in three systematic reviews,¹⁰⁻¹² was not performed in a duplicate manner by two independent reviewers. The data extraction was not conducted by two independent reviewers in three systematic reviews.¹¹⁻¹³ The quality assessment of the included studies was not performed in one systematic review¹³ and quality assessment was not performed in a duplicate manner by two independent reviewers in two systematic reviews.^{10,12} The overall methodological quality of the included studies were generally considered either low to moderate,^{11,12,14} or was not reported.¹⁰ Unmet AMSTAR criteria also included a list of excluded studies was not provided and appropriately considering the scientific quality of the included studies in formulating conclusions. The methodological quality of two included systematic reviews,^{11,13} were considered poor per AMSTAR criteria because literature search was not comprehensive. In addition, efficacy and safety data was not pooled, but was reported individually at study level in one SR,¹³ or not pooled for comparing B-TURP with M-TURP or other procedures one systematic review.¹¹ Finally, one more limitation of the overall body evidence presented in this document was the included randomized control trials overlapped significantly across all the included five systematic reviews.

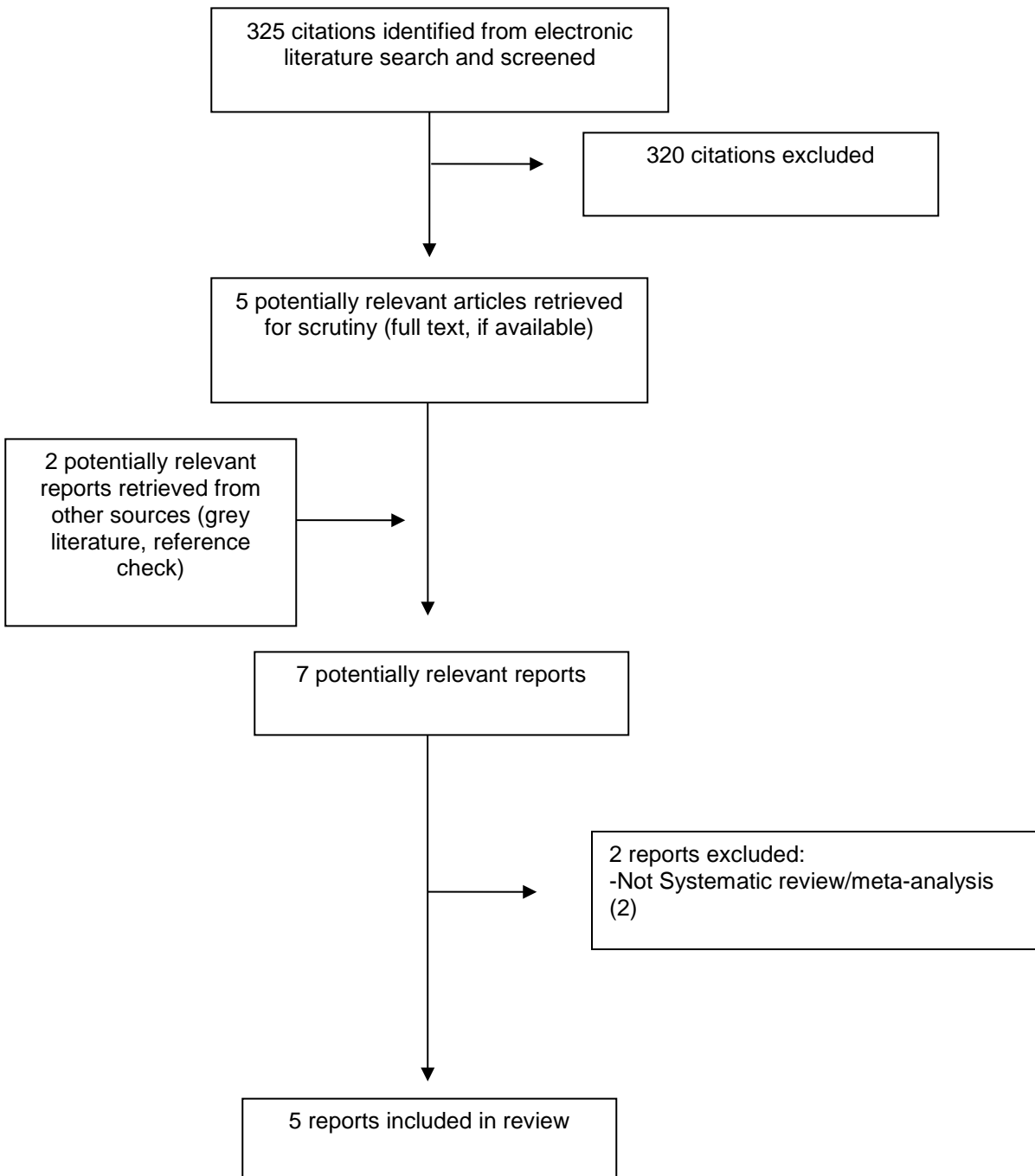
Conclusions and Implications for Decision or Policy Making

The evidence reviewed in this document suggested a similar clinical efficacy comparing B-TURP and M-TURP, but B-TURP may be associated with fewer adverse events. There was no evidence identified to comparing B-TURP with GreenLight laser treatment. No cost-effectiveness evidence on B-TURP compared with M-TURP or GreenLight laser treatment was identified. Various methodological limitations were highlighted in the included systematic reviews and as such the results of this review should be interpreted with caution. There is a need for further well-conducted, multicenter randomized control trials with long-term follow-up data.

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Appendix 1: Selection of Included Studies



Appendix 2: Characteristics of Included Publications

Table 2: Characteristics of Included Systematic Review

First Author, Publication Year, Country	Study Design/ Length of Follow-up	Patient Characteristics,	Intervention	Comparator(s)	Clinical Outcomes
Cornu 2015, Paris, Germany, Switzerland, The Netherlands, New Zealand, USA, Italy, Australia and Austria ¹²	SR/MA N=69 RCTs; Lit search period: 1992-2013 Follow up Duration of RCTs: ≥ 1 year	Patients with BPO	B-TURP	●M-TURP ●HoLEP	IPSS MUFR PVRV Prostate volume AEs
da Silva 2015, USA ¹³	SR (No MA was done) N=14 RCTs (for B-TURP) Lit search period: 2005-2015; Follow up duration of RCTs: 12 to 48 mons	Patients with BPH	B-TURP	●M-TURP ●HoLEP ●BPVP ●BPEP	●Operative time, ●Catheterization time ● Number of blood products transfused, ●Hospital stay ●PVRV ●AEs.
Tang, 2014 China ¹⁰	SR/MA N=31 RCTs; Lit search period: up to July 2013; Follow up duration of RCTs: 3 to 48 mons	Patients with BPH	B-TURP	M-TURP	●IPSS ●MUFR (Qmax) ●AEs ●The time of catheter removal
Omar 2014, Greece ¹⁴	SR/MA N=24 RCTs; Lit search: 1966 to 2012; Follow up duration of RCTs: 3 to 48 mons	Patients with BPH	B-TURP	M-TURP	●IPSS ●HRQL ●MUFR (Qmax) ●AEs
Lee, 2013, Korea ¹¹	MA N=36 RCTs; Lit search period: 1997 to 2011; Follow up duration of RCTs: 3 to 36 moms.	Patients with BPH	B-TURP	●M-TURP ●HoLEP ●BPVP ●KTP ●TUVF	●IPSS ●HRQL ●MUFR (Qmax) ●AEs

B - TURP = bipolar transurethral resection of the prostate; BPVP = bipolar plasma vaporization of the prostate; BPEP = bipolar plasmakinetic enucleation of the prostate; BPH = benign prostatic hyperplasia or hypertrophy; BPO = benign prostatic obstruction; HoLEP = holmium laser enucleation of the prostate; HRQL = Health-related quality of life; IPSS = International Prostate Symptom Score; Lit – literature; KTP = potassium-titanyl-phosphate; MA=meta-analyses MUFR = maximum urinary flow rate; PVRV = post-void residual volume; M-TURP = monopolar transurethral resection of the prostate; PVP = photo-selective vaporization of the prostate; RCTs=randomized control trials; SR= systematic review; TUVF = transurethral vaporization of the prostate; US = Urethral stricture;

Appendix 3: Critical Appraisal of Included SRs

Table 3: Strengths and Limitations of Systematic Reviews and Meta-Analyses using AMSTAR

Strengths	Limitations
Cornu 2015, ¹²	
<ul style="list-style-type: none"> Research questions and selection criteria were defined and presented Comprehensive literature search based on pre-defined criteria List of included studies provided Quality assessment of the included studies was described (by Jadad score) Methods used to combine the findings was clearly reported Publication bias was assessed (by funnel plots analysis) Conflict of interests declared 	<ul style="list-style-type: none"> List of excluded studies not provided Whether the two independent investigators performed study selection, and data extraction and quality assessment was not described Whether the quality of included studies was considered in the analysis and conclusion was not clearly indicated
da Silva 2015, ¹³	
<ul style="list-style-type: none"> Research questions and selection criteria were defined and presented 2 independent investigators performed study selection, List of included studies provided Declared no financial conflict of interests 	<ul style="list-style-type: none"> Only one database (Medline) was searched based on pre-defined criteria List of excluded studies not provided Whether the 2 independent investigators performed data extraction was not described. Quality assessment of the included studies was not described. Data was not pooled (No MA was done)
Tang, 2014 ¹⁰	
<ul style="list-style-type: none"> Research questions and selection criteria were defined and presented Comprehensive literature search based on pre-defined criteria Two independent investigators performed data extraction List of included studies provided Quality assessment of the included studies was described (by Jadad score) Methods used to combine the findings was clearly reported Publication bias was assessed (by funnel plots analysis) Declared no financial conflict of interests 	<ul style="list-style-type: none"> List of excluded studies not provided Whether two independent investigators performed study selection, and quality assessment was not described Whether the quality of included studies was considered in the analysis and conclusion was not clearly indicated. QA data was not reported
Omar 2014, ¹⁴	
<ul style="list-style-type: none"> Research questions and selection criteria were defined and presented Comprehensive literature search based on pre-defined criteria Two independent investigators performed Study selection, data extraction and quality assessment. List of included studies provided 	<ul style="list-style-type: none"> List of excluded studies not provided Whether the quality of included studies was considered in the analysis and conclusion was not clearly indicated.

Strengths	Limitations
<ul style="list-style-type: none"> • Quality assessment (QA) of the included studies was described and QA data were reported (by Cochrane collaboration criteria) • Methods used to combine the findings was clearly reported • Publication bias was assessed (by funnel plots analysis) • Declared no conflict of interests 	
Lee, 2013,¹¹	
<ul style="list-style-type: none"> • Research questions and selection criteria were defined and presented • Two independent investigators performed QA • List of included studies provided • Quality assessment of the included studies was described (by Jadad score, CCRBT and VTS) • Methods used to combine the findings was clearly reported • Declared no financial conflict of interests 	<ul style="list-style-type: none"> • Only one database (Medline) was searched based on pre-defined criteria • List of excluded studies not provided • Whether two independent investigators performed study selection, and data extraction was not described • Whether the quality of included studies was considered in the analysis and conclusion was not clearly indicated. Overall QA data was summarized, but no individual QA data was reported. • Publication bias was not described

AMSTAR=A Measurement Tool to Assess the Methodological Quality of Systematic Reviews; CCRBT = Cochrane Collaboration Risk of Bias Tool; VTS = van Tulder scale

Note: The methodological quality of the Systematic Review and Meta-analysis were assessed with AMSTAR³

Appendix 4: Main Findings and Author's Conclusions in SRs

Table 4: Summary of Findings of Included SR

Main Study Findings	Author's Conclusion
Cornu 2015, ¹²	
<p>B-TURP vs. M-TURP</p> <p><u>Outcomes assessed at 12 mos</u></p> <p>Efficacy at 12 mo: MD (95%CI), p value</p> <p>IPSS: -0.12 (-0.34, 0.11), p = 0.31;</p> <p>MUFR (Qmax): 1.26 [0.31, 2.21], p = 0.009;</p> <p>QROL: -0.10 (-0.29, 0.10), p = 0.32;</p> <p>Prostate volume: -1.21 (-2.91, 0.49), p = 0.16;</p> <p>PVR: -4.15 (-9.27, 0.98), p = 0.11;</p> <p>Complications at 12 mo: OR(95%CI), p value</p> <p>Urethral strictures: 1.20 (0.80, 1.80), p = 0.39;</p> <p>Incontinence rate: 0.68 (0.28, 1.65), p = 0.40;</p> <p>Reoperation: 0.66 (0.25, 1.72), p = 0.39;</p> <p><u>Outcomes assessed as ≥ 24 mos</u></p> <p>Efficacy at ≥ 24 mos: MD (95%CI), p value</p> <p>IPSS: 0.49 (-0.02, 1.00), p = 0.06;</p> <p>MUFR (Qmax): 1.00 (-0.32, 2.33), p = 0.14;</p> <p>PVR: 1.10 (-8.67, 10.87), p = 0.83;</p> <p>Complications at >24 mos: OR(95%CI), p value</p> <p>Urethral strictures: 0.95 (0.48, 1.88), p = 0.89;</p> <p>Bladder neck contracture: 1.14 (0.53, 2.45), p = 0.75</p> <p>Reoperation rate: 1.25 (0.74, 2.11), p = 0.40;</p> <p><u>Perioperative data: MD (95%CI), p value</u></p> <p>Intervention duration (min):</p> <p>-1.51 (-5.15, 2.12), p = 0.41</p> <p>Hemoglobin loss:</p> <p>-0.43 (-0.61, -0.26), p < 0.00001;</p>	<p>“...As TURP is still seen as the reference treatment, bipolar TURP has shown favorable outcomes with lower short-term complications... but supplemental evidence is needed to compare the PVP 180W XPS device and modern competitors (including B-TURP and HoLEP)”(p1093)¹²</p>

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<p>Serum sodium decrease; -3.01 (-4.56, -1.46), $p = 0.0001$;</p> <p>Catheterization time: -17.14 (-22.94, -11.35), $p < 0.00001$;</p> <p>Length of stay: -0.79 (-1.32, -0.27), $p = 0.03$;</p> <p>Perioperative complications: <u>OR(95%CI), p value</u></p> <p>Transfusion rate; OR(95%CI), p value 0.49 (0.32, 0.74), $p = 0.0009$;</p> <p>UTI: OR(95%CI), p value 1.03 (0.64, 1.66), $p = 0.9$;</p> <p>Immediate acute urinary retention: OR(95%CI), p value 0.68 (0.47, 0.98), $p = 0.04$;</p> <p>Clot retention; OR(95%CI), p value 0.47 (0.31, 0.70), $p = 0.0002$;</p> <p>Recatheterization: 0.86 (0.37, 1.99), $p = 0.73$</p> <p>Immediate reoperation rate: 0.43 (0.21, 0.88) $P = 0.02$;</p> <p>Transurethral resection syndrome; 0.22 (0.09, 0.56), $p = 0.02$;</p>	
da Silva 2015, ¹³	
<p>B-TURP vs. M-TURP (n=9 RCTs) B-TURP vs. laser resection (n=2 RCTs) B-TURP vs. plasma enucleation (n=1 RCT) B-TURP vs. plasma vaporization (n=2 RCTs)</p> <p><i>Data was not pooled for any outcomes and any comparison above</i></p> <p>Overall, compared B-TURP with M-TURP, plasma enucleation and vaporization, the findings were inconsistently reported across the included RCTs in terms of functional outcomes (such as IPSS), operation time; catheterization time, hospital stay and adverse events.</p>	<p>"The use of bipolar energy in the surgical treatment of patients with BPH is safe and is associated with improvements in perioperative outcomes. Short and mid-term functional outcomes are comparable to standard techniques, but long term functional outcomes need better clinical evaluation"(p30)¹³</p>
Tang, 2014 ¹⁰	
<p>M-TURP vs. B-TURP <u>Efficacy at 12 mos: MD (95%CI), P value</u></p> <p>MUFR (Qmax): -0.36 (-0.82, 0.09), $p = 0.12$;</p>	<p>"This systematic review indicates that B-TURP was significantly better in the result of Qmax and for decreasing the incidence of TUR syndrome and clot retention. No significant differences were observed in the nature of adverse events such as transfusions, retention after catheter removal, and urethral</p>

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<p><u>Complications: Risk difference (RD, 95%CI), P value</u></p> <p>TUR syndrome: 0.02 (0.01, 0.03), p = 0.0004;</p> <p>Incidence of clot retention: 0.04 (0.02, 0.06), p < 0.001;</p> <p>Blood transfusion: 0.02 (0.01, 0.04), p = 0.0005;</p> <p>Urethral strictures: -0.00 (-0.02, 0.02), p = 0.95;</p> <p>Bladder neck constrictions: 0.02 (-0.00, 0.03), p = 0.08;</p> <p><u>Cauterization time: MD (95%CI), P value</u></p> <p>14.95 (13.59, 16.31), p < 0.00001</p>	<p>complications between both groups. Thus, B-TURP is the next generation "gold standard" for benign prostatic obstruction (BPO) because it is associated with a lower rate of clinically relevant complications such as TUR syndrome and clot retention"(p1107)¹⁰</p>
Omar 2014, ¹⁴	
<p>B-TURP vs. M-TURP</p> <p><u>Efficacy at 12 mos: MD (95%CI), P value</u></p> <p>MUFR: 1.30 (0.77, 1.83), p < 0.001;</p> <p><u>AEs: Risk ratio (RR, 95%CI), P value</u></p> <p>TURS: 0.12 (0.05, 0.31), P < 0.001;</p> <p>Blood transfusion: 0.53 (0.35, 0.82), p = 0.004;</p> <p>Clot retention: 0.48 (0.30, 0.77), p = 0.02;</p> <p>Incontinence: 0.67 (0.19, 2.34); p = 0.53</p> <p>Urethral strictures: 0.97 (0.61, 1.54), p = 0.91;</p> <p>Need for a second procedure: 0.76 (0.44, 1.28), p = 0.30;</p> <p>Urinary tract infection: 0.86 (0.48, 1.54), p = 0.60</p> <p>Acute retention after removal of catheter: 0.87 (0.48, 1.59), p = 0.65</p>	<p>"Whilst there is no overall difference between monopolar and bipolar TURP for clinical effectiveness, bipolar TURP is associated with fewer adverse events and therefore has a superior safety profile. Various methodological limitations were highlighted in the included trials and as such the results of this review should be interpreted with caution. There is a need for further well-conducted, multicenter RCTs with long-term follow-up data"(p24)¹⁴</p>
Lee, 2013, ¹¹	
<p>No pooled data was reported to compare B-TURP with M-TURP. It was reported that B-TURP showed comparable functional outcomes to TURP (mixture of B-TURP with M-TURP). Moreover, B-TURP showed a shorter length of Foley catheterization and lower intraoperative and perioperative complications.</p>	<p>"... Bipolar TURP, bipolar transurethral vaporization of the prostate, HoLEP, and open prostatectomy showed superior outcome in postvoid residual urine volume and maximum flow rate. The intraoperative complications of the minimally invasive surgeries had no statistically significant inferior outcomes compared with TURP. Also, there were no statistically significant differences in any of the modalities compared with TURP. The selection of an appropriate surgical modality for BPH should be assessed by fully understanding each patient's clinical conditions"(p59)¹¹</p>

B - TURP = bipolar transurethral resection of the prostate; BPVP = bipolar plasma vaporization of the prostate; BPEP = bipolar plasmakinetic enucleation of the prostate; CI = confidence interval; HoLEP = holmium laser enucleation of the prostate; HRQL = Health-related quality of life; IPSS = International Prostate Symptom Score; KTP = potassium-titanyl-phosphate; MA=meta-analyses; MD = mean difference; MO = month; MUFR = maximum urinary flow rate; PVRV = post-void residual volume; M-TURP = monopolar transurethral resection of the prostate; OR odds ratio; PVP = photo-selective vaporization of the prostate; PVR = postvoid residual; Qmax = maximum urine flow rate; RCTs=randomized control trials; RD = risk difference (the difference between the observed risks, i.e. the proportions of patients with AEs) in the two groups ; RR = risk ratio or relative risk (the ratio of the probability of patients with an AE between two groups); SR= systematic review; TUVp = transurethral vaporization of the prostate; TURS = TUR syndrome; US = Urethral stricture; UTI = Urinary tract infections.